and the author of the notice referred to is therefore invited to furnish a parallel calculation, based upon the theories which have hitherto received general support. This invitation the writer must decline, simply because two far abler hands than his have already investigated this problem on the lines which he would have pursued; and he could add nothing to the authority that accompanies the utterances of Dr. J. R. Hind, the Superintendent of the English "Nautical Almanac," and Prof. Simon Newcomb, the Superintendent of the American.

The following is Mr. Page's communication:—

"Herodotus speaks of the eclipse of Thales as follows:—'A war commenced between the Lydians and the Medes, . . . which continued five years; and it is remarkable that one of their engagements took place in the night. In the sixth year, when they were carrying on the war with nearly equal success, on the occasion of an engagement, it happened that in the heat of battle day was suddenly turned into night' (Herodotus, b. i., s. 74).

"This battle was fought on the morning of the (Julian) July 8, or 9 days after the solstice; consequently in the time of longest days and hottest weather. It would seem from the above account that it commenced in the night, and was not ended until the time of the eclipse, or 5.24 a.m.; when the armies ceased fighting on account of their fears.

"From Ptolemy's canon we learn that Cyaxares, King of Media, began to reign B.C. 634, and reigned 40 years, during 28 of which the Scythians ruled over Asia. In B.C. 606 the Scythian power was broken, and the Medes and Babylonians conquered Assyria. Soon afterwards (*i.e.* in B.C. 603) that war broke out between Lydia and Media which was terminated by mutual fears of this eclipse. As the King of Media reigned 40 years from B.C. 634, he must have died B.C. 594, which is the latest date that can be fixed for the eclipse; and as he was 28 years subject to the Scythians, he must have reigned 12 years after the defeat of the Scythians in B.C. 606; and as his war with the Lydians could not have taken place for several years after this, and as the eclipse was in the sixth year of the war, the date of the eclipse cannot possibly be placed earlier than B.C. 600: consequently we are compelled to look for it some time between B.C. 600 and B.C. 594."

Appended to this communication is a calculation by Mr. Page of the time of new moon in B.C. 597. This calculation is founded upon Ferguson's tables, to which some corrections have been applied by the computer. The calculation cannot be given here in detail; but the result to which Mr. Page is led is July 8, 5h. 24m. 11s., as that at which the so-called eclipse of Thales occurred. This date differs some twelve years from that which has been assigned by the two authorities just mentioned, viz. B.C. 585—a date, too, which accords with that mentioned by Pliny, reckoned by Olympiads. But those who find Mr. Page's arguments sufficient will agree with him; my regret is rather that he has chosen to build his theory on absolute tables, and to ignore all that the ablest astronomers and mathematicians have recently been able to accomplish in this direction.

William E. Plummer.

The Rotation of Mercury.

In your issue for January 16 (xli. p. 257), Schiaparelli's observations on the planet Mercury are stated to lead that astronomer to the conclusion that "Mercury revolves around the sun in the same manner that the moon revolves round the earth, always presenting to it the same hemisphere."

Permit me to recall the fact that, as a matter of deductive reasoning, I recorded this opinion in 1883: "The powerful tidal action experienced by Mercury has greatly retarded its primitive axial motion, and increased its distance from the sun. No surprise would be occasioned by the proof that the planet has already attained to synchronistic motions" ("World-Life," p. 425). This opinion was accompanied by calculations of the solar tidal efficiency on Mercury.

Alexander Winchell.

Ann Arbor, Michigan, U.S.A., August 4.

Wet and Dry Bulb Thermometers.

It may, perhaps, interest you to know that on Friday last the difference between the wet and dry bulb thermometers, on board this ship in Grimsby roads, amounted to $12\frac{1}{2}^{\circ}$; the dry bulb showing 66°, and the wet bulb $53^{\circ}\cdot5$. Wind west; force, 7 to 8 by Beaufort's scale. This is the greatest difference I have recorded in this country for ten years.

T. H. Tizard.

H.M.S. *Triton*, Grimsby, August 17.

Experiment in Subjective Colours.

The following experiment does not seem to be widely known: it is not easy to make a clear explanation of the lenses.

Take a number of the *Graphic* and a piece of thin paper, which, if put upon the ordinary print, allows it to be seen through, as black. Now put the paper over some of the large black letters on the apple-green outer cover: seen through the paper, they appear as bright red.

W. B. Croft.

Winchester College, August 18.

THE SCIENCE AND ART MUSEUM, DUBLIN, AND THE NATIONAL LIBRARY OF IRELAND.

In the year 1877 the Natural History Museum and the Library of the Royal Dublin Society, which, though mainly supported for many years by Parliamentary grants, had been directly managed by the Society, were, by Act of Parliament, transferred to the Science and Art Department, a large sum of money having been at the same time paid by Government to the Society for ceding its rights and property.

Soon afterwards steps were taken by the Science and Art Department for providing suitable accommodation for an art and industrial addition to the Museum. Into a consideration of the various causes which delayed the carrying out of this project we need not enter here; they will be found described in the Reports of the Science and Art Department.

At length, in 1884, a final competition between rival architects' designs for the new buildings was arrived at, and those by Messrs. Deane and Son, of Dublin, were chosen by the representative committee, which was specially appointed for the purpose of selection.

The sites for these buildings, which were adopted after much discussion, are at right angles to Leinster House on its Kildare Street or western side. The *façades* of both buildings, which face one another, are about 200 feet long, and are similar, consisting of two rotundas with colonnades, and pavilions at the sides. In the centre of the Museum building is a large court about 125 feet by 75 feet. Opening from it there are in all 24 galleries or rooms, which are devoted to exhibiting purposes.

The foundations were laid by His Royal Highness the Prince of Wales on April 10, 1885, the ceremony connected therewith being the most important presided over by His Royal Highness during his last visit to Ireland.

The tender for the erection of the buildings by Messrs. Beckett Brothers, of Dublin, was accepted on November 3, and by the 17th operations had commenced. In four years, or by November 1889, the Museum building was completed, and was handed over to the Science and Art Department, and the transfer to the new galleries of the collections which had accumulated in the temporary premises during twelve years was at once proceeded with.

It was not until June of the present year that the sister building, for the reception of the National Library of Ireland, was completed. During the month of July the transfer of the books, consisting of about 100,000 volumes, from the old Library in Leinster House, has been satisfactorily accomplished.

Both institutions are about to be opened on the 29th of the present month by His Excellency the Lord-Lieutenant, after which they will continue to remain open and free to the public.

It may be of interest to add some details as to the principal contents and system of arrangement in the two institutions respectively. In order to describe the Museum effectively, it is necessary to include here an account of the collections in the Natural History Department, which, however, remain in their old quarters—a very suitable building on Leinster Lawn. It has for a pendant a similar building, the National Gallery of Painting, which is, however, under different management. The relative positions of the five buildings may be compared to a capital H, in which the cross bar represents Leinster House, and the other portions of the letter the four buildings which have been referred to, with Leinster Lawn and the courtyard of Leinster House between them. Close by there is another group of buildings, which contains the class-rooms of the Metropolitan School of Art.

Leinster House, which is comparable in a sense to Burlington House, affords accommodation to the officers of the Science and Art Department in administrative charge of the various institutions, and also to the Royal Dublin Society, which, since it has been relieved of its mangement of the several institutions, has considerably developed its various functions in science and agriculture ; for the due carrying out of the latter it has provided itself with extensive show yards at Ball's Bridge in the suburbs of Dublin, where the cattle shows, &c., have acquired an importance and success never attained while they continued to be held in the City premises.

The Society is possessed, moreover, of a large private library, and its members enjoy various privileges, such as the use of a general reading-room, free admission to meetings, lectures, &c. The Society has recently entered upon several new lines for the development and encouragement of the arts and industries of Ireland.

Returning to the Museum—the building which contains the natural history collection consists of two large rooms or halls, one on the basement and the other on the first floor, the latter having two galleries. The basement room contains the systematic collections of fish, reptiles, a number of large recent and fossil skeletons, and groups illustrative of the geographical distribution of animals.

In the lobby of the first-floor room there is a special collection of the mammals of Great Britain and Ireland, and in the room itself the main systematic collection of mammals is arranged in a row of large central cases, and the invertebrate collections in table and wall cases at the sides. As in some of the other groups, there are special collections of Irish invertebrates.

The first gallery contains a general collection of stuffed birds, and a special collection of Irish birds. In the second gallery there are general collections of insects, and of birds' nests and eggs. A room off this gallery contains a large collection of birds' skins arranged in glazed drawers, for study. Besides the above, there are considerable collections of invertebrates—especially of insects—in the curators' rooms.

A large annex, which was formerly occupied temporarily by a portion of the art collections, has been made use of for the display of the palæontological collections, which are of some extent and importance. The specimens of plant and animal fossils are for the most part arranged systematically ; they include large numbers of fossils from the Sivalik Hills in India, and many well-known casts of generalized types of animals. The special collections, not incorporated, include an extensive one of Irish mammals, Sir Richard Griffith's collection of Irish Carboniferous and Silurian fossils, and several collections of Arctic fossils made by Sir F. Leopold McClintock and others.

From this annex a passage affords access to the new building which is about to be opened. In the first two rooms the collections of fossils, rocks, and minerals, which have been made by the Geological Survey of Ireland, are exhibited. In an adjoining room there is the general Museum collection of minerals, with a small one of meteorites. The next room is devoted to a large relief map of Ireland, coloured geologically. It is on the horizontal scale of one inch to a mile, the vertical scale, as is usual, being considerably exaggerated. In this room there are also a number of photographs representing natural phenomena, including some large transparencies which were presented by the United States Government. The corresponding rooms on the other side of the building are devoted respectively to (1) Greece and Rome ; (2) Egypt and Assyria ; (3) Ethnography, a very extensive and important collection ; (4) Musical instruments ; (5) India and Persia.

The Central Court, from which these rooms open off, is devoted mainly to casts of antique and mediæval sculptures, and to a large number of models of statues and busts by the late J. H. Foley. Close by is the rotunda, a hall which has been compared to Napoleon's tomb. It contains casts of antique sculptures, and in the centre a group of three bronze guns, with their carriages, &c., which were taken at Sobraon and Maharajpur, and presented to Lord Gough by the Honourable East India Company.

Ascending to the first floor, we meet in succession rooms devoted to (1) textiles (lace and embroidery) · (2) wood carving ; (3) glass and ceramics ; (4) furniture ; (5) casts of ivories and metal-work ; and on the opposite side (1) woven materials, models of looms, &c. ; (2) industrial models ; (3) and (4) rooms intended for the famous collections of Irish antiquities made by the Royal Irish Academy ; and (5) arms and armour. The gallery of the Central Court contains a number of casts of Celtic antiquities, a large collection of metal-work, and electrotypes, besides many other objects of considerable interest. In the gallery of the rotunda there are a number of casts of modern sculptures, &c.

On the south side of the building there is a second floor containing four rooms ; these have been allotted to the Herbarium and Botanical Museum, the collections included in which are considerable, having been brought together from many different quarters. They have not yet, however, been arranged for public inspection. The various collections of Cryptogams are, perhaps, the most valuable. There are also several well-known collections of Irish plants.

It will be seen from the above sketch that this Museum covers a very wide field. This will be still further apparent from a study of the general "Guide" which is about to be issued.

There are some special features in the arrangement of the specimens which may be touched upon briefly. The objects in the Museum are largely provided with fully descriptive labels and maps. In the mounting of the specimens many novel devices have been made use of, and some ingenious contrivances have been founded upon inventions which, though used in American museums, have not hitherto been adopted in Europe.

The Museum is open free to the public daily, Sunday and two week-day evenings being included. The daily average attendance is about 600, and there is every reason for believing that the institution, which is now about to be fairly launched on its more extended career, will become increasingly popular and increasingly instructive to the people of Ireland.

The National Library is being arranged in its new quarters, upon principles which have been for many years the subject of earnest consideration and study by the librarian, Mr. William Archer, F.R.S.

The principal public reading-room is a very handsome apartment, capable of accommodating 200 readers. With the exception of a few works of reference, such as dictionaries, &c., the books are all arranged in stores, which are close at hand, in one of the wings of the building. These stores are in five stories, which are connected by ordinary (not spiral) stairs of low gradient, and the books are arranged on free standing presses, within easy reach of hand and eye ; thus no ladders are required, and no wall presses are used. Although the ultimate potential storage capacity of the building when complete may be extended to 600,000 volumes, at present only about 100,000 have to be provided for.

The arrangement of the books is according to a modification of the decimal system of Mr. Dewey, of the State Library of New York. It is claimed for this system that it brings together on the shelves all works of cognate character, be they general or specific.

Within the space available here it is not possible to fully illustrate this system, but a few lines may be devoted to explaining the general principles of the method. The whole Library must be regarded as being divided into nine libraries, numbered as follows: (1) Philosophy, (2) Religion, &c., (5) Natural Science, and up to (9) History. Each of these is again divisible, *if necessary*, into nine parts.

Thus the number 54 represents the 4th division (Chemistry) of the 5th class (Natural Science); 541 represents Theoretical Chemistry, and 5412 represents the 2nd division (Atomic Theory) of Theoretical Chemistry.

Every book as it is received in the Library will receive a number, which will at the same time indicate its place on the shelves, and be a summary of its contents.

When he receives the *title* from a reader, the attendant will, after a little practice, be able to go directly and without reference to the place marks, to the exact shelf or quarter of the stores by simply translating the title into its corresponding number.

One advantage of the system is that the special works contained in the Library on a given subject can always be seen together at a glance. It is needless to point out that the complex character of many books will furnish complex exceptions to the more simple nomenclature.

The Library, as an all-round, modern, working student's library in science and literature, is a very valuable one, though it is not at present so in the sense that it contains any particular literary treasures.

The administration of these several institutions, together with the Botanic Gardens at Glasnevin, and the Metropolitan School of Art, is carried on by the Science and Art Department, which is represented locally by the Director of the Science and Art Museum, under whom there are heads of the several departments and institutions. Two local bodies were created in 1877 to aid the Department in the supervision of these institutions, one the Board of Visitors of the Museum and Botanic Gardens, and the other the Council of Trustees of the National Library, the functions of the latter including the selection of books for the Library.

The total cost of the several institutions is provided in the annual estimates of the Science and Art Department which are voted by Parliament.

COMPARISON OF THE SPECTRA OF NEBULÆ AND STARS OF GROUPS I. AND II. WITH THOSE OF COMETS AND AURORÆ.[1]

II.

General Comparisons.

IN the preceding article I showed that the spectra of nebulæ, auroræ, bright-line stars, and stars of Group II. are closely related to the spectra of comets. In the table which follows, all the spectra are brought together and compared. It is not sufficient to show that each group resembles comets in some respects, as each one might have some feature which was absent in the other. I therefore give the following table to show how far they resemble each other. In the last column the dark bands which are simply due to absence of radiation, and are not really absorption-bands, are omitted.

Nebulæ.	Aurora.	Comets.	Bright-line Stars.	Stars with Mixed Flutings.
4101	411	—	4101	—
—	426	[426]	—	—
—	431	431	—	449 (bright space)
434	435	—	434	—
447	—	—	—	—
—	—	—	—	461–451 bright
468–474	474–478	468–474	468–474	472–476 bright
479	482	483	—	—
486	486	486	486	—
4958	—	—	—	4958–486 bright
500	500	500	—	502–4959 dark
509	—	—	507	—
517	517	517	517	516–502 bright
—	519	519	—	—
520	522	521	—	522–516 dark
—	—	—	—	524–527 dark
527	—	[527]	527	—
—	531	—	—	—
—	535	—	—	—
—	539	—	540	—
546	545	546	—	544–551 dark
554	—	—	—	—
559	558	558	558	559–564 dark
—	—	561	—	—
—	—	564	564	—
—	—	568	568	—
—	—	[579]	579	—
—	—	—	—	585–594 dark
5872 (D_3)	—	—	5872	—
—	—	[589]	589	—
—	606	—	—	—
—	620	[615]	—	616–630 dark
—	630	—	635	—

It will be seen that there are three flutings which run through the five columns, namely, 468–474, 517, and 558—these are due to carbon and manganese, and are the familiar cometary bands; four more—hydrogen 486, magnesium 500, magnesium 521, and lead 546—occur in four out of the five columns. Out of the thirty-four lines or flutings given, there are nineteen which occur in less than three columns, but this number is greatly reduced when slight differences of temperature, masking effects, and the exceptional conditions of comets are taken into account.

It is now universally agreed that comets are swarms of meteorites, and the tables which I have given show that nebulæ, bright-line stars, stars with mixed flutings, and the aurora, have spectra closely resembling those of comets, the special features of which are the carbon bands, to which I have recently added the absorption bands of manganese and lead; all are therefore probably meteoritic phenomena.

The following is a list of the bodies which contain either one or both of the carbon flutings near 517 and 468–474, the latter being a group of flutings, which, as I have before shown (Roy. Soc. Proc., vol. 35, p. 167), sometimes has its point of maximum brightness shifted from 474 to 468. The fluting near 564 has been omitted from the table, as it is generally masked, either by continuous spectrum or by the superposition of the fluting of manganese near 558. The wave-lengths given are as measured by the various observers stated.

The spectrum of the aurora is added for the sake of completeness.

It will be seen from the table that the record of the presence of carbon is unbroken from a planetary nebula through stars with bright lines to those resembling α Herculis, *i.e.* entirely through Groups I. and II. of my classification.

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[1] Continued from p. 345.